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Prequalification testing of 290/500 (525) kV extruded cable system at IREQ

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Résumé:

Un système de transport d'énergie électrique par câbles à isolation synthétique a satisfait aux essais de préqualification prescrits par Hydro-Québec et Bewag. Après avoir réussi le programme de préqualification pour 345 kV et effectué des essais d'investigation de 345 à 500 kV, le câblier a entamé un programme d'essais de préqualification pour le niveau 500 kV. Le présent travail décrit pour la première fois la préqualification d'un système de transport d'énergie électrique par câble à isolation synthétique et jonctions prémoulées pour le niveau 500 kV suivant les recommandations CIGRÉ.

Abstract:

An EHV extruded cable system has successfully passed the Hydro-Québec and Bewag prequalification tests at 345 kV and 400 kV respectively. Upon completion of the 345-kV program and a special engineering test of 19 cycles from 350 kV to 500 kV, the supplier launched a prequalification test program for a 500-kV extruded cable system. This presentation describes the first-ever prequalification testing of 500-kV extruded cable system with premolded joint based on the CIGRE Working Group 21.03 recommendations.

Introduction

Extruded cables and accessories have not only been qualified at 500 kV in the past (1994), in Japan, but a 40-km 500-kV line is now under construction in Tokyo [1]. The joints used in the tests and now being installed on the new line are of the extruded molded type (EMJ). The reliability of these joints no longer needs to be demonstrated but there are two major limitations to its use: installation in tunnels and a minimum one-month installation time for a highly skilled personnel to complete all three phases.

This paper reports on an alternative to the EMJ joint which is simpler in structure, easier to install and not in need of such highly skilled workers. The joint was tested as part of a loop comprising cable and accessories which was installed for prequalification tests at 345 kV in 1995. After completion of the long-term test at Hydro-Québec's cable testing facility in Varennes, the complete cable loop was subjected to lightning (1300 kV) and switching (900 kV) impulses and an AC withstand test of 450 kV for 1 h. Having passed the Hydro-Québec prequalification tests [2], the loop was then subjected to an additional test of 19 cycles ranging from 400 kV to 500 kV. It was only after these tests were successfully completed that a comprehensive prequalification test program at 500 kV was defined in accordance with the recommendations made by CIGRÉ Working Group 21.03 [3].

Subsequently, a supplementary long term test at 400 kV was carried out to satisfy the French standard C33-253. Finally, a number of tests were performed for engineering investigations:

AC test from 550 kV up to 750 kV

Switching impulses at 1300 kV (\pm)

Lightning impulses at 1425 kV to 1925 (\pm)

Lightning impulses up to 2100 kV (negative polarity)

Experimental

The test loop at the Varennes research facility was set up in the same way as a standard Hydro-Québec installation, as shown in Figure 1. Approximately 165 m, it included a structure 4 m high for the two outdoor terminations, epoxy-reinforced fiberglass ducts 200 mm in diameter, a current transformer manhole, a joint and a GIS termination manhole. The A-A and B-B duct bank sections of the cable layout are presented in Figures 2 and 3 respectively.

The joint was installed in a manhole 11 m long, 3 m wide and 3 m high. The cable and joint were rigidly clamped in the manhole and the cable was also anchored in the section just below the termination. The GIS terminations were installed in a back-to-back configuration in another manhole.